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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/527,873	03/17/2000	Sohaila Shooshtarian	AGX-37	4182

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EXAMINER	
LEE, HSIEN MING	
ART UNIT	**PAPER NUMBER**
2823	

DATE MAILED: 12/20/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/527,873	SHOOSHTARIAN ET AL.	
	Examiner	Art Unit	
	Hsien-ming Lee	2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 October 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2,4-13,42 and 44-63* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,4-13,42 and 44-63* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

HSIEN-MING LEE
PRIMARY EXAMINER
Lee 12/15/2004

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *101204*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Grounds of Rejections

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1, 2, 5, 8-13, 44, 45, 48, 50-51, 53, 56-60, 62 and 63 are rejected under 35 U.S.C. 102(b) as being anticipated by Mahawilli (US 5,814,365).

In re claims 1, 44, 45, 48, 50, 62 and 63, Mahawilli, in Figs. 1-6 and related text, expressly and impliedly teaches the claimed method for heat treating a semiconductor wafer, comprising :

- placing a semiconductor 12 in a thermal processing chamber 10 that is in communication with a plurality of lamps (tungsten-halogen lamps (not shown), col. 5, lines 4-15), the semiconductor wafer 12 defining a plurality of localized regions (i.e. discrete areas) along a radical axis;
- adjusting the temperature of the semiconductor wafer 12 to a predetermined temperature according to a predetermined heat cycle including a heating stage 14 in which the semiconductor wafer 12 is heated by the plurality of lamps; and
- during at least one stage of the predetermined heat cycle, providing a gas through gas injection segment 36, 38, 40 to selectively control the temperature of at least one of localized regions of the semiconductor wafer 12 to minimize temperature deviation of

the at least one localized region from the predetermined temperature (i.e. to **achieve temperature uniformity** throughout localized or discrete regions on the entire wafer by **selectively delivering gas flow**, with the assistance of the *continuous temperature measurement* via a non-contact photon density measuring device, so that the gas flow is directed to the **center** of the substrate **less than** directed to the perimeter of the substrate, **col. 3**, lines **43-47** and **53-58**; **col. 4**, lines **13-19;** col. **4, line 60 through** col. **5, line 3**; col. **6**, lines **50-55** and **62-67**; and col. **10**, lines **28-39)**, the gas being supplied by a gas injection assembly 34 *above* the semiconductor wafer 12 (Fig.3) and a *plurality of gas outlets*_36A-36D, 38A-38D, 40A-40D (Fig.5).

In re claims 2, 5, 51, 53, Mahawilli also teaches monitoring the temperature of said at least one localized region with a temperature sensing device 60 and 84 (col. 8, lines 36-37; col. 9, lines 39-43), said temperature sensing device 60 and 84 being in communication with a controller (col. 9, lines 39-51); and based on information received by said controller from said temperature sensing device 60 and 84, controlling the temperature of said at least one localized region according to said predetermined heat cycle; and controlling the flow rate of the gas (col. 10, lines 34-39).

In re claims 8-10, 56-58, Mahawilli inherently teaches that said at least one localized region comprises less than about 50% or 25 % or 15 % of a cross-section of said semiconductor wafer because Mahawilli's method is to pursuit the temperature uniformity on every discrete area region across the entire wafer (col. 10, lines 36-37).

In re claim 11, Mahawilli inherently teaches that said temperature of said at least one localized region is decreased during said heating stage of said predetermined heat cycle

because the temperature would increase and decrease within a predetermined cycle and is further controlled within a target range by controller during temperature controlling.

In re claims 12, 13, 59, 60, Mahawilli inherently teaches that said predetermined heat cycle further comprises a cooling stage; and said temperature of said at least one localized region is increased and decreased during said cooling stage of said predetermined heat cycle because the temperature would be fluctuating during temperature adjustment via controller.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 4, 6, 7, 42, 46-47, 49, 52, 54, 55 and 61 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mahawilli in view of Champetier et al (US 5,874,711).

In re claims 4 and 52, controlling the temperature of the gas is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species. In re Jones, 162 USPQ 224 (CCPA 1955)(the selection of optimum ranges within prior art general conditions is obvious) and In re Boesch, 205 USPQ 215 (CCPA 1980)(discovery of optimum value of result effective variable in a known process is obvious). Particularly, Mahawilli's method is to pursuit temperature uniformity across the entire wafer by selectively control gas rate with the assistance of a controller. One of the ordinary skilled in the art would have been motivated to control gas temperature to achieve temperature uniformity.

In re claims 6, 7, 54 and 55, these claims are prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ2d 1685, 1688(Fed. Cir. 1996)(claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and In re Aller, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious). Particularly, Mahawilli indicated that the method is to achieve temperature uniformity across the wafer. One of the ordinary skilled in the art would have been motivated to utilize Mahawilli's method to minimize the temperature deviation within an optimized range as claimed.

In re claims 42, 46-47, 49 and 61, Mahawilli substantially teach the claimed method, as stated above, but do not teach that the gas is supplied by a reflective device located below the semiconductor wafer.

Champetier et al, in an analogous art of heat treating processing, teach utilizing the reflective device 26 located below the semiconductor wafer 14 (Fig.1), wherein the reflective device 26 is constructed by coating a reflective layer 36 (i.e. highly reflective material such as stainless steel or optical film, col. 12, lines 33-35) on a pedestal.

Therefore, it would have been obvious to one of the ordinary skill in the art, at the time of the invention was made, to modify the method of Mahawilli by providing the gas assembly below the wafer instead of above wafer; and by coating the reflective layer on the pedestal or

platform, as taught by Champetier et al, so that the platform 28 of Mahawilli becomes the reflective device in a such way that gas outlets extending through the reflective device located below the wafer, since by this manner it would provide more accurate temperature measurements. (col. 2, lines 62-64, Champetier et al)

Response to Arguments

5. Applicant's arguments filed 10/12/2004 have been fully considered but they are not persuasive for the reasons as follows.

In re 102(b) rejection, applicants have argued that Mahawili does not ever state or suggest that gas flow through the gas injection assembly 34 would selectively control the temperature deviation of at least one of the localized regions of a semiconductor wafer (first paragraph, page 10) and asserted that the gas injection assembly 34 is merely for producing "uniform deposition on the substrate" (second paragraph, page 10).

Contrary to the arguments, Mahawili teaches that the gas injection assembly comprises a plurality of gas injectors, the gas injectors being grouped into at least two groups of gas injectors (col. 3, lines 38-40). Each group of gas injectors is capable of **selectively delivering** at least reactant gas and an inert gas so that the gas flow can be independently controlled (col. 3, lines 43-47). Furthermore, by **selectively controlling** the gas flow, more gas flow are delivered to the peripheral region of the wafer than to the central region of the wafer (col. 3, lines 53-56) so that the **profile of the heat** on the wafer can be adjusted (col. 4, line 62 through col. 5, line 3). The selective control or adjustment of the gas flow is based on a feedback from **a temperature measuring device,** i.e. a photon density measuring device (abstract, lines 9-11 and 21-22; col. 10, lines 31-34). By selectively adjusting the gas flow at different localized regions of the wafer,

, it would achieve **temperature uniformity** across the entire wafer surface during film deposition or annealing (col. 2, lines 23-27). In other words, the temperature uniformity or temperature deviation across the entire wafer, which comprises a plurality of localized regions, is affected by the selective adjustment of the gas flow. Accordingly, Mahawili does teach "providing as gas to selectively control the temperature of at least one of the localized regions of a semiconductor wafer to minimize temperature deviation of said at least one localized region."

In re 103(a) rejection, applicant further argued that Champetier et al. do not remedy the deficiency in Mahawili merely because Champetier et al. do not teach or suggest "providing as gas to selectively control the temperature of at least one of the localized regions of a semiconductor wafer to minimize temperature deviation of said at least one localized region from a predetermined temperature."

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). In this case, the teaching of Champetier et al. is used to remedy the deficiency in the teaching of Mahawili that the gas is supplied y a reflective device located below the semiconductor wafer. By integrating the reflective device, as taught by Champetier et al., with the teaching of Mahawili, the gas outlets in Mahawili can extend through the reflective device located below the substrate or wafer. By this manner, it would be beneficial for more accurate temperature measurements. (col. 2, lines 62-64, Champetier et al)

For the reasons given above, the rejection is deemed proper.

Conclusion

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hsien-ming Lee whose telephone number is 571-272-1863. The examiner can normally be reached on Tuesday-Thursday (8:00 ~ 6:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 571-272-1855. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR

system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Hsien-ming Lee
Primary Examiner
Art Unit 2823

Dec. 15, 2004

HSIEN-MING LEE
PRIMARY EXAMINER
12/15/2004